

small granules close to the anterior margin, no eyes. Venter and coxæ with similar granules, often giving rise to a fine hair. Palpus large, stout; femur more than twice as long as broad, with about four pointed tubercles above and below on outer side 3 long spines toward base, one on inner side toward tip; patella nearly as long as the tibia, four tubercles above, and below on each side one long spine; tibia about two and one-fourth times as long as broad, with three spines below on each side, the middle one much the largest, the apical one next in size; tarsus about three-fourths the length of the tibia, with two spines below on each side, the basal one the larger; claw slender, nearly one-half as long as the tarsus. Mandibles with some tubercles in front and above. Legs slender, finely granulate; femur I reaches to tip of femur of palpus; the patellæ are larger than the other joints and quite long, the tarsus is divided into long slender joints, all clothed with fine short hairs. The posterior margin of each abdominal segment above and below is elevated. Length, 1.8 mm.

Several specimens from Alabaster Cave, California [Marx].

NOTES ON OVA AND LARVA OF HYPERCHIRIA PAMINA.

BY DR. R. E. KUNZÉ.

While collecting in Prescott, Ariz., found a ♀ *Pamina*, June 23, 1898, which oviposited, June 24th, one hundred eggs. I retained thirty, which hatched twenty days later, July 13th, 8 A.M., exact time for first larvæ to appear. I sent sixteen ova to Professor Packard, and gave the others to a friend on the Summit Mountains to raise if possible. Nights were very cool, and thought that no ova would hatch, so long in coming out.

Ovum white, a black spot on top. Length, 2 mm. Width, $1\frac{3}{4}$ mm. Shape subconical, depressed on sides. Ova laid in piles composed of parallel rows.

Young larvæ after hatching: length $5\frac{1}{2}$ –6 mm. when in motion, and 4 mm. at rest. Width of body $\frac{1}{3}$ mm. Color dull orange or buff, head black. Dorsum with double row of gray tubercles, surmounted by black bifurcated spine. A subdorsal row of tubercles of a greenish-gray. Lateral parts below covered with whitish hair. Head shining black, covered sparsely by whitish hair. Thoracic and prolegs concolorous with body. A few hours after hatching larva changed to a brownish color, spines black. Larvæ were fed on *Quercus undulata*.

I had to return to Phoenix, where oak does not grow, and therefore gave *Salix fluviatilis* for larvæ to feed upon. Only fifteen accepted the change of food. The others gradually died between July 18th and 21st, and July 23d all were dead.

Larva eight days old. Head shining black, covered with whitish hair; round in shape. Ground color of body, which is cylindrical, light umber-brown all over, inclined to lighter tints on abdominal parts. Dorsal and lateral parts covered by bunches of spines, which like the shafts are black. Two rows of dorsal shafts and one each subdorsal. Segments 2 to 4, each bear a transverse row of four bunches of stinging spines. Shaft bifurcated, fork two-thirds as long as the stem, tip surmounted by a long, black, curved spine, and some of dorsal row by two spines. Shafts of segment 2 not so long as of 3 and 4. Segments 5 to 13 each contains a transverse row of four black, tuberculous shafts, each bearing a spine, and those of dorsal row a second rudimentary one. The subdorsal shafts only half so long as those of two dorsal rows. Thoracic legs darker than prolegs. Body sparingly covered by whitish secondary hairs. Length of larva at rest 6 mm., in motion 7 mm. Width 1 mm.

All the other larvæ died inside of two weeks, although feeding constantly on *Quercus undulata*, an oak they are mostly found on.

On my next trip to Prescott I found forty-nine spinose, black-looking larvæ on *Quercus undulata*, August 8, 1898, which proved to be *Pamina*. These were gregarious and when disturbed dropped to the ground. They would follow one another like *H. io*, but did not rest in similar rows, more sardine-fashion. Apparently the larvæ represented the beginning of third stage. Examined larvæ August 11th, at noon. Length of larvæ 16 mm. at rest and 18 mm. when in motion. Width across middle of body 3 mm., and that including spines 5 mm. Antennæ brown, mouth parts light brown. Body covered by six longitudinal rows of black, tapering, spinulated tubercles, having on the largest of second joint 19-20 black, fleshy protuberances or spinules, each with a seta at the end. The two dorsal rows have longest tubercles. On segment 2, tubercles are 4 mm. long. Between the black spines of dorsal tubercles is a mass of whitish, woolly hair. Color of body sooty black. Head shining black. A fine white, interrupted dorsal stripe lines each side of both rows of the tubercles on dorsum. There is a white, uneven, interrupted double line between subdorsal and infraspircular row of tubercles.

Size of tubercles gradually tapers less toward abdominal segments. At the base of subdorsal and infraspicular tubercles the spines are white and in bunches. Each segment from the first and including eleventh has six spinulated tubercles. Those of first are not quite so long as on second segment, but longer than any other. Head retracts into first segment. There are five tubercles on twelfth segment, and the dorsal ones longer than on any other joint. On the thirteenth segment are five spinulated tubercles, of which four in a row and the fifth placed behind the two dorsal ones on anal plate. Dorsal tubercles of same length as of twelfth segment. Thoracic legs black, feet brown. Prolegs reddish-brown, clasping surface covered by white hair. A longitudinal, reddish-brown stripe, enclosing a white line, passes centrally over entire abdominal surface.

I remained only one week in Prescott, and took three of the larvæ to Phoenix, for further observation, but all were dead by August 18th, when supply of oak gave out. I removed a small bush to Phoenix, planted in a shady spot, but it refused to live under all circumstances. My other larvæ of the same brood I left in Prescott, and these were fed up to transformation on *Quercus undulata*.

Observed that the tubercles of supra- and infraspicular row were black, and that all spinules therefrom were white, with a white seta at the end. Of the dorsal rows of tubercles, the white spinules occupied the lower third of each tubercle. Could not distinguish spiracles with a magnifier. A triangular depression above the face, the apex of which meets the vertical line of forehead.

Sept. 9, 1898, received two nearly full-grown larvæ from Prescott for observation. Length of larva at rest 38 mm. Width 7 mm. Body of larva cylindrical. Head shining black, with median suture. A triangular depression on clypeus. Mouth parts blackish. Antennæ brownish. A few scattering hairs on lower part of face. Width of head $3\frac{1}{2}$ mm. Anterior part of 2d segment sooty, posterior half white with blackish patch in the middle. Between the subdorsal row of spines, a shining black ridge, with spur between dorsal and subdorsal bunch of spines. Ground color of the dorsal surface from segments 3-13, white, relieved by six longitudinal, broken black lines. The dorsal lines farther apart than subdorsal. In the middle of each segment back of the shaft of spines, are five transverse black dashes. Two of the central dashes are in a continuous broken line with the dorsal black lines. On segment 13, these transverse dashes are very

faint. On segments 5-11, between the dorsal tufts is an elongate black spot, with its long axis lateral. On segments 3 and 13, this black spot is quadrate, with long axis lengthwise. Subdorsally on segments 5-11, a broad, black interrupted band, its sections on the posterior part of joint 6 and anterior part of 7, forming a subquadrate spot; in the middle over the incisure is a white spot. An irregular, broken black subdorsal line passes over segments 3-5, and on anterior half of segment 6. On posterior half of each segment an irregular, quadrate chestnut-colored, almost ferruginous spot, concolorous with abdominal feet. On the anterior half a similar, more triangular rusty spot. A black spot between ferruginous ones, dotted whitish. Each segment from 5-9, across the stigmatal line, is obliquely crossed on anterior part of each joint by two heavy white lines, enclosing a black dash. On posterior part of the segment from bunch of spines to incisure, is a narrow white line. The lateral parts of segments 2-5, below stigmatal tufts are sooty. Segments 2-6 has a substigmatal bunch of small, whitish spines, thus giving each joint 8 bunches. Segments 7-10, each has 6 spinose tufts or bunches. Segment 11 has 8 such tufts. Segment 12 has 7 tufts, the largest dorsally, and segment 13 has 5 tufts, the central one a little below subdorsal tufts, and of same length as the substigmatal tufts. Shafts all black. Lower third of each spinose tuft white, upper part black. Dorsal tufts of segments 2 and 3 are the longest, from 7-8 mm. Tufts of segment 13 are 7 mm. long. Stigmata light buff. Thoracic feet ferruginous and black. Abdominal legs blackish-brown, the feet ferruginous, covered by fine white hair. Abdominal parts brownish-red, enclosing a longitudinal whitish line. Supra-anal plate shining black above, edged white below and reddish-brown between white lines. Two white dashes on a line with subdorsal tufts of segment 13. Upper part of clasper black, below ferruginous, covered by fine white hair.

The largest larva measured in length at rest 43 mm., and in motion 48 mm. Width $6\frac{1}{2}$ mm. Occipital part of head greenish. A triangular greenish depression on clypeus. A greenish stripe passes obliquely across the face and nearly meets at triangle of the clypeus. Mouth-parts reddish. Above maxillary a transverse whitish bar. Antennæ reddish and white at base. The ground color of dorsal and lateral parts is made up of alternate, narrow longitudinal stripes of lavender and white, separated by black lines. On dorsum a lavender

stripe, bordered by a subdorsal white one. Then a very narrow lavender stripe on a line with right and left row of dorsal tuft of spines. Next, another white stripe followed by a substigmatal stripe, as broad as the one on dorsum. This is bordered by an irregular, alternate single and double white infrastigmatal stripe. This stripe is double on the anterior part of each segment, and passes obliquely downward toward the legs.

The lower part of shafts greenish white, terminal end black, surmounted by a black spine and seta. The longest shafts on segments 2, 3 and 13, are two-thirds black on top and greenish-white at the base. Lower two-thirds of all the spines of the tufts greenish-white, almost pea-green in tint, and tips of the upper and topmost spines black. The transverse black spot on dorsum of segments 5-11, surrounded by a pinkish tint. Spiracles cream-colored. Infraspicular parts alternately marked by red and black patches, minutely dotted white. A broad black band across upper part of abdominal legs, red below and dotted white. Claspings surface red. Thoracic feet red and black. Abdominal parts reddish and finely dotted white, and a yellowish longitudinal stripe passing over all segments. Anal plate black and reddish, dotted white, the clasper reddish. Thoracic and abdominal feet covered by fine white hair.

Near Prescott I found this beautiful larva at an altitude of 5,400 feet and up to a little over 6,000 feet. The food-plants were *Quercus undulata*; *Ceanothus fendleri*; a white-flowered, prickly bush bearing red berries, *Cercocarpus parvifolius*, or Mountain Mahogany, a small shrub from 2-15 feet high, the bark of which is aromatic like winter-green; and in southern Arizona, of Huachuca Mts., found a few larvæ on *Quercus emoryi* or Black-jack Oak, which bears edible acorns. One larva was found on *Opuntia spec.*, in Yavapai County.